minium in the first instance with a considerable amount of sulphuric acid. This gave us a mixture which, on analysis, was found to contain 18·5 per cent. of sulphate of lead. This mixture, when submitted to the reducing action of a current yielded a mass of spongy lead that contained only a mere trace of sulphate.

As it seemed desirable fully to establish the fact that the sulphate of lead formed on the discharge of a cell is reduced in the subsequent charging, we took the quondam lead plate of a fully discharged cell, determined the proportion of sulphate to unaltered spongy lead, and submitted it to the reducing action of a current. The amount of sulphate on the plate before passing the current was found to be 51 per cent., but, after the passage of a current, of about an ampère for 60 hours, not a trace of it remained.

Hence it may be concluded that, during the alternate discharging and re-charging of a Planté or Faure cell, sulphate of lead is alternately formed and reduced on the lead plate, and that the plate itself is not seriously corroded. It would, however, appear desirable not to allow the whole of the spongy lead to be reduced to sulphate during the discharge, for two reasons, viz. : (1) because the supporting plate stands a chance of being itself acted on if there is not a sufficient excess of spongy metal ; and (2) because the presence of this excess tends to facilitate the reduction of the sulphate.

We have already shown that sulphate of lead is produced by the local action that takes place between the peroxide and its supporting lead plate during repose. The same local action also takes place during the charging of the plate, as was pointed out in our second communication, and this sulphate is, in its turn, attacked by the electrolytic oxygen. In this way the absorption of oxygen in forming the negative plate ought never to come to an end. In order to see whether this was the case, we allowed an experiment to continue for 115 hours, although the main action was over in about forty hours. For the last two days of the experiment, the amount of oxygen absorbed was pretty constant, being about 9 c.c. per hour, which is equivalent to 0·24 grms. of sulphate of lead formed and oxidated. The whole charge on the plate was forty grms. of peroxide. This local action also takes place during the discharge, as is evidenced by the sulphate of lead formed on the negative plate always exceeding in amount that formed on the positive plate.

Through this local action taking place during the formation of the cell, during repose, and during the discharge, the lead plate which supports the peroxide must be continually corroded more and more ; and it is probably due to the insolubility of the sulphate formed that the destruction of this kind of secondary battery is so materially retarded in practice.

J. H. GLADSTONE
ALFRED TRIBE

REFLECTIONS ON READING "DEGENERATION": AN ESSAY, BY E. R. L., F.R.S.

THE Ascidian came down like a wolf on the fold
  In the ages ere Earth had grown wrinkled and old,
He peered through the waves with his cerebral eye,
Frisked his tail, and dashed after the innocent fry.

Like the leaves of the forest when Summer is green
That gay host of youthful Ascidians was seen,
Like the leaves of the forest when Autumn has blown
Their helpless descendants lie glued to a stone.

For the Angel of Darwin came, gentle and bland,
And lapped them in comfort and fed them by hand,
And their eye myelonic waxed useless and blind,
And their caudal appendage was cut off behind.

And there lies the sea-squirt with gill-slits all wide
And through them there eddies the nutritive tide,
Half mollusc, half vertebrate, solve him who can,
A riddle, a lesson for curious Man.

J. H. P.

ILLUSTRATIONS OF NEW OR RARE ANIMALS IN THE ZOOLOGICAL SOCIETY'S LIVING COLLECTION[1]

IX.

23. THE PIGMY HOG (*Porcula salvania*).—Few additions to the Zoological Society's living collection of late years have attracted more attention than the Pigmy Hogs of Nepaul, of which the first specimens ever imported into Europe reached the Gardens in May last.

For our first knowledge of the existence of this diminutive form of the pig-family in the sub-Himalayan forests we are indebted to the researches of Mr. Bryan H. Hodgson, formerly Resident at the Court of Nepaul, who described the Pigmy Hog so long ago as 1847, in an article published in the Journal of the Asiatic Society of Bengal. He named it *Porcula salvania*, from the forest of Saul trees (*Shorea robusta*), in which it is chiefly found. While the Wild Boar, or a species closely resembling it abounds all over India, the Pigmy Hog is exclusively confined, as Mr. Hodgson tells us, to the deep recesses of the primeval forests of the Terai of Nepaul and Bhotan, where it roams about in herds. It is very rarely seen even by the natives. A well-known hunter informed Mr. Hodgson that during fifty years' abode in the Saul forests he had obtained but three or four of these animals to eat, partly owing to their scarcity, and partly to the speed with which the females and young disperse, and to the extraordinary vigour and activity with which the males defend themselves while their families are retreating. Dr. Jerdon in his volume on the Mammals of India, tells us that the full-grown males live constantly with the herd, which consists from five to twenty individuals, and are its habitual and resolute defenders against harm. These animals feed principally upon roots and bulbs, but also devour birds' nests, eggs, insects, and reptiles. The female has a litter of from three to four young ones. Dr. Jerdon adds, that whilst at Darjeeling, he in vain endeavoured to procure a specimen of it from the Sikkim Terai, and Sir Joseph Fayrer, who hunted many years in the Terai, was also unsuccessful in meeting with the Pigmy Hog.

Under these circumstances, it will be readily understood that the authorities of the Society have been much pleased at the recent acquisition of a small herd of these animals, consisting of a male and three females, of one of which we give an illustration (Fig. 23). They were obtained in the Western Dooars of Bhootan after vast trouble and expense, and were brought to England by Mr. B. H. Carew, who has parted with them to the Society. They were caught by Mr. Carew's hunters in snares which were set for them in hundreds, over a range of country twenty miles in extent. Though on their first arrival they were very wild, they are already becoming tame and confidential, and are, it is hoped, likely to breed.

In its general appearance the Pigmy Hog is not unlike a small variety of the common boar, but measures only about 1 foot 2 inches in length, and has but a very small tail. The colour is a nearly uniform brown, slightly shaded with dirty amber. The coat of hair is thin, except upon the back. The Pigmy Hogs will be found by visitors to the Zoological Society's Gardens in what is usually called the Ostrich House, just beyond the Zebra House, where a compartment has been specially fitted up for their accommodation.

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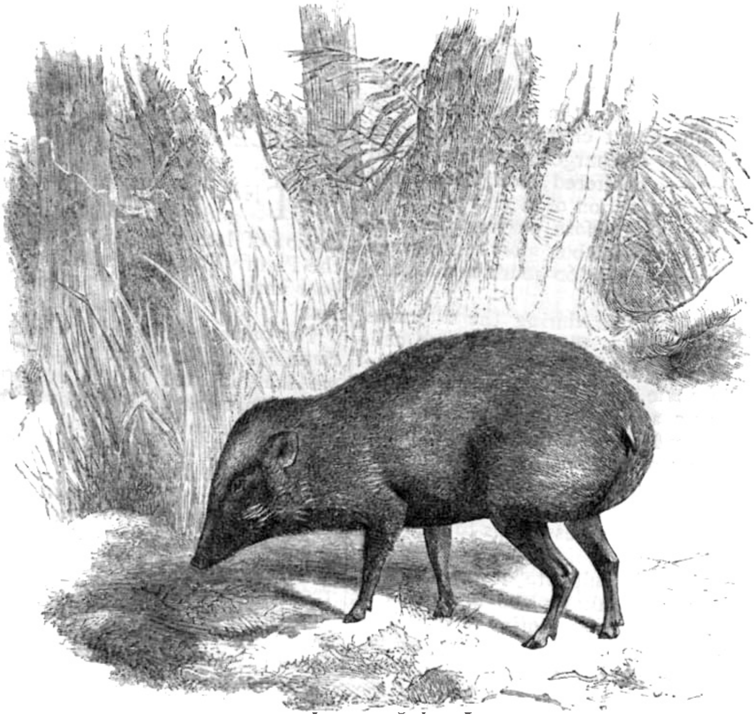
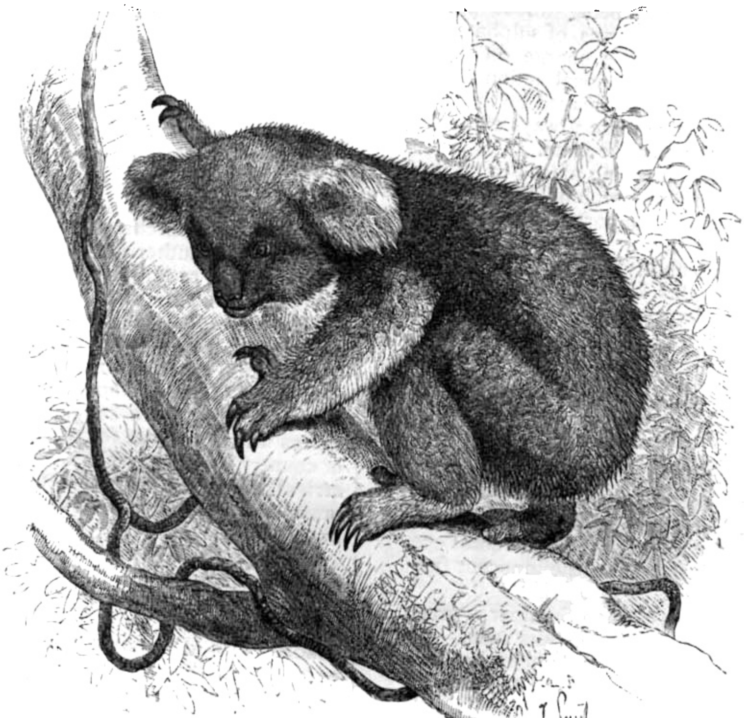
[1] Continued from p. 134.

24. THE KOALA (*Thascolarctos cinereus*). For many years was deemed impossible to keep the Koala, or Native Sloth of Australia, alive in captivity. Great and persistent efforts, it was said, had been made by many persons in various parts of the Australian Colonies to induce this curious little animal to submit to confinement. But as they never survived long, even under the most favourable conditions in Australia, it was hopeless to expect that we should ever see this animal living in London.





These prophecies, however, like other forebodings on more serious subjects, have turned out to be fallacious. In April, 1880, the Society acquired a living example of this animal in excellent health. It had been brought home from Australia along with a large barrel of the dried leaves of one of the gum-trees (*Eucalyptus*), upon which scanty diet, however, it appeared to have thriven well during the voyage. On being placed in a compartment of a room fitted up specially for it with branches to climb about upon, and supplied with fresh gum-tree leaves and a little bread and milk, it continued to prosper admirably, until it lost its life by an untoward accident.

The specimen had not been replaced until May last, when a second example, from which our Fig. (24) has been taken, was acquired of a London dealer, and seems, like its predecessor, likely to do well in this country under similar treatment.

The Koala is nocturnal or semi-nocturnal in its habits. In the daytime it is usually seen coiled up asleep on the topmost branch of its cage. In the evening it descends to munch the leaves of the *Eucalypts* provided for its food, but it never seems to be very active in its movements, and does not appear to have much intelligence.

In its native land, as we are told by Gould, in the first volume of his "Mammals of Australia," the Koala inhabits the dense and luxuriant bushes stretching along the south-eastern coast of the continent from Port Phillip to Moreton Bay, and the cedar-bushes of the mountain ranges of the interior. It is apparently confined to the south-east of Australia. It is recluse in its habits, hiding in the day time in the dense foliage of the eucalypti or native gum trees, so that without the aid of the natives it is not easily detected. By these, however, it is readily discovered, and captured by the aid of their waddies or throwing-sticks. It is exceedingly tenacious of life, clinging to the branches after being shot until perfectly dead.

The Koala, when full grown, is about 2 feet in length, and about 18 inches in girth. The limbs are strong and muscular, and the long clawed feet are well adapted to its arboreal habits. On the fore-feet the two innermost toes are so arranged that they form, as it were, a double thumb, and act against the three outer, thus giving to the foot the grasping power of a hand; whilst on the hinder foot the inner toe is very large, nailless, and thumb-like, and acts against the four long-clawed outer toes in a manner resembling that of the thumb. The head is rounded and the muzzle short, the ears are not of large size, their prominent appearance being given to them by the very long hairs with which they are covered. These in the adult are fully two inches in length, and on the outer side of the ears are of the same grey hue as the rest of the body. The fur covering the body is long, soft, and rather woolly; the general colour may be described as ashy-grey, with an under-tint of brown.

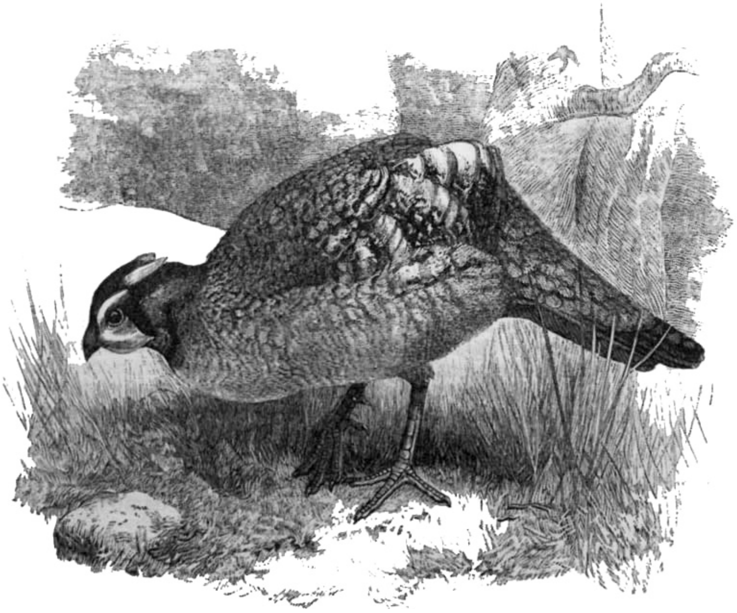


FIG. 25.—The Cabot's Tragopan.

The natives of Australia are said to be very fond of the flesh of the Kaola, and readily join in the pursuit of it; they examine with wonderful rapidity and minuteness the branches of the loftiest gum tree, and upon discovering a Koala, they climb the treee with as much ease and expedition as a European would mount a tolerably high ladder. Having reached the branches, which are sometimes forty or fifty feet from the ground, they follow the animal to the extremity of a bough, and either kill it with a tomahawk, or take it alive.

Thus persecuted by the natives, and driven into the interior by the progress of civilisation, the Koala is now getting rare in many districts near the coast, where it was formerly abundant, and even for Australians the Gardens of the Zoological Society of London will shortly become perhaps the most convenient place to inspect this strange animal.

25. THE CABOT'S TRAGOPAN (*Ceriornis caboti*).—The Tragopans, or Horned Pheasants, constituting the genus *Ceriornis* of naturalists, must be ranked amongst the finest and most brilliantly coloured representatives of the splendid group of Indian game birds. Two of them—the Crimson Tragopan of the Central and Eastern Himalayas, and the Black-headed Tragopan of the Western Himalayas and Cashmere, are well known to Indian Sportsmen, and are familiar objects of pursuit, though we believe, by no means easily procured. The Crimson Tragopan was introduced into Europe by the Zoological Society in 1859, and has frequently bred in their Gardens, as has likewise the Temminck's Tragopan (*Ceriornis temmincki*), first received by the Society in 1864. Of the Black-headed Tragopans a pair was acquired in the spring of the present year, but this species, so far as we know, has not yet reproduced in Europe.

Between the furthest known eastern range of the Crimson Tragopan and the frontiers of China a fourth species of *Ceriornis* has its home. This is Blyth's Tragopan (*C. blythi*), first discovered in the Mishmi Hills by the late Dr. Jordin during his excursion to Assam in 1869, and subsequently met with by Major Godwin-Austen in the Naga Hills, south of the Brahmaputra. Blyth's Tragopan has likewise been once exhibited alive in the Zoological Society's Gardens, an adult male of this fine bird having been presented to the collection by Major Montagu in 1870. Little, however, is yet known of it.

The fifth and last species of Tragopan, which we now figure (Fig. 25), from an example lately acquired by the Zoological Society, is still more rare and little known than the four above-mentioned members of the genus. Cabot's Tragopan, as it is called, was described in 1857 by the late Mr. Gould, and subsequently figured in his great illustrated work on the Birds of Asia. Its habitat is South-Eastern China, but little is yet known of its exact range. The only naturalist who has met with it in its native wilds is the celebrated Chinese explorer, M. le Père David. M. David, in his "Oiseaux de la Chine," tells us that he found this fine Gallinaceous bird rather common in the wooded mountainous range which separates the provinces of Fokien and Kiangsi, when he traversed this district in the autumn of 1873, and obtained many examples for the French National Collection.

So far as has been recorded, the male specimen of this Tragopan, received by the Zoological Society in April last is the only example that has reached Europe alive.

THE ROT IN SHEEP, OR THE LIFE-HISTORY OF THE LIVER-FLUKE

THE winter of 1879-80 was marked by a widely-spread outbreak of the liver-rot amongst our sheep. The losses during that winter were estimated at three million sheep, or about one-tenth of the total number in the United Kingdom, and during the following winter the losses were equally severe. It had long been known that the disease was due to the presence in large numbers of a parasite called the liver-fluke (*Fasciola hepatica*) in the liver of the affected animals, and that the parasite invaded sheep or sometimes other animals allowed to feed on wet pastures, and especially on flooded ground. But notwithstanding that the question had been repeatedly investigated by numerous zoologists, including Prof. Leuckart, so well known for his researches on parasites, the manner in which the disease was incurred remained a complete mystery. It was known indeed that the animals most nearly allied to the liver-fluke, the digenetic Trematodes, presented an alternation of generations, and that they possessed larval forms infesting various species of molluscs. These nurse-forms, as they are called, produce internally larvæ, usually tailed, known as cercariæ, which leave the nurse and encyst themselves in some other mollusc or in aquatic insect larvæ, &c., and remain there quiescent, only reaching maturity if swallowed together with the animal harbouring them by some suitable vertebrate host. Such is a typical instance of the development of a trematode with alternation of generations, but there is a good deal of variety in the life-histories of the different species. It was supposed that the liver-fluke had a somewhat similar life-history, but all attempts to discover what mollusc served as intermediate host had been fruitless.

The Royal Agricultural Society of England was induced by the heavy losses of sheep in 1879-80 to offer a grant for the investigation of the natural history of this most destructive parasite. I undertook the research, and the results of my work during the summer and autumn of 1880 were published in the Journal of the Society for April 1881. Certain slugs had been suggested as probable bearers of the larval form of the liver-fluke, and I was able to show that these conjectures had little evidence to support them, and suggested that *Limnæus truncatulus* was really the intermediate host, or at least one of the intermediate hosts of the liver-fluke. For on the Earl of Abingdon's estate at Wytham, I examined thoroughly a clearly circumscribed area of infection situated on the side of a hill far above the reach of floods, and found that almost the only species of water-snail occurring on the ground was *Limnæus truncatulus*, found in a boggy spot. This contained an interesting form of cercaria, produced in a cylindrical redia, or nurse-form provided with digestive tract.

The free cercaria had a body of oval form, about 0·3 mm. ($\frac{1}{80}$ in.) in length, but was of very changeable shape. The two suckers characteristic of the adult forms of the family of the *Distomidæ* were of nearly equal size, the oral sucker about terminal, and the ventral sucker near the middle of the ventral surface. The anterior part of the body was covered, at least in the most mature examples, with exceedingly minute spines. But the most striking character of the cercaria was due to lobed lateral masses extending the whole length of the body on each side of the middle line. These lobed masses were an opaque white from the multitude of granules composing them. The cercaria had a tail, which, when fully extended, was more than twice the length of the body. It was exceedingly active, but soon came to rest, showing a strong tendency to encyst itself on surrounding objects. It contracted so as to assume a rounded form, and exuded a mucous substance, containing numerous opaque granules derived from the lateral masses described, which were thus shown to be a special larval organ, producing the substance of which the cyst was composed. The tail continued to wag violently, and was at length pinched off as it were by the hardening wall of the cyst. The cysts were snowy white by reflected light, but on rupturing them the included larvæ was found to be quite transparent. I had a few months previously seen a sheep which I had the best possible reason for knowing to be infected with flukes, wandering over the boggy spot from which the snail containing the cercaria came, and the presence of so highly developed an organ for the production of the substance of the cyst in a cercaria which encysted on any plants at hand, seemed to indicate that here was the cercaria of the liver-fluke, and it has since been proved that such was the case. Moreover, I had collected evidence from independent sources, which rendered it probable that the parasite was taken up by the sheep while grazing from the damp roots of grass, most likely in the encysted condition.

Of this cercaria I wrote at the time as follows :—"The structure and habits of this cercaria render it possible that it may prove to be the larva of *Fasciola hepatica*, but want of material has prevented my testing the question by giving the cyst to rabbits. I intend, however, to pursue this case further."

Accordingly, during the summer of 1881, I endeavoured to procure *L. truncatulus* in order to put my strong suspicion to the test of experiment. But I was unfortunately unable to find any, even in the localities where I had found it during the previous year. In my search I had on many occasions the skilled assistance of my friend and colleague Mr. W. Hatchett Jackson, but we never found any other trace of this species than the empty shells. The localities for the snail mentioned by Whiteave in his paper on the mollusca inhabiting the neighbourhood of Oxford, were searched, but without success. My friends at a distance were appealed to, but were unable to assist me. There can be little doubt that the freedom of sheep near Oxford from the liver-rot during last winter was directly connected with the real scarcity of this snail. This year, however, there were floods on the Isis in July, and *L. truncatulus* was brought down by the water in vast quantities, probably from marshy ground far up the river. So numerous were they that I repeatedly obtained